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Dairy goat health management and milk production on organic and conventional system in Brazil

Estudo comparativo da produção e manejo sanitário entre cabras leiteiras orgânica e convencional no Brasil

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Abstract

The aimed of this article is to measure risk factors on health and milk production on organic and conventional dairy goats in Brazil. Two experimental groups (organic and conventional) were evaluated simultaneously. The study design was completely randomized. The organic herd consisted of 25 goats and 15 kids. In the conventional production system, a dairy herd comprising 40 goats and 20 kids participated in the study. Data on milk production and health management were available from January 2007 to December 2009. The abortion rate in the conventional system was 5% (2/40) whereas in organic system no abortion was diagnosed (0/25). The mortality rate at weaning in the conventional system was 5% (2/40) and in the organic system was 8% (2/25). Milk production was lower (2.20 kg/day) in organic than conventional system (2.66 kg/day). Goats and kids in organic farm had a higher FEC (386±104 and 900±204, respectively) ($p<0.05$) than those in conventional farm (245±132 and 634±212, respectively). In addition, Saanen kids had higher FEC ($p<0.001$) than goats. Treatment with antiparasitic drugs was higher in conventional system (50%) than organic system (1.3%).

Key words: Conventional system, goat, milk production, organic system, parasites

Resumo

O objetivo do artigo foi mensurar os fatores de risco referentes ao manejo sanitário e a produção entre cabras leiteiras sob sistema orgânico e convencional. Dois grupos experimentais (orgânico e convencional) foram conduzidos simultaneamente. O desenho do estudo foi o inteiramente casualizado. O rebanho orgânico consistiu de 25 cabras e 15 cabritos e o sistema convencional por 40 cabras e 20 cabritos. Os parâmetros produtivos e sanitários foram monitorados entre janeiro de 2007 a dezembro de 2009. No sistema convencional, houve uma taxa de aborto de 5% (2/40), enquanto que no sistema orgânico nenhum aborto foi diagnosticado (0/25). A taxa de mortalidade ao desmame no sistema convencional foi de 5% (2/40) e no sistema orgânico foi de 8% (2/25). A produção de leite média diária por cabra no rebanho leiteiro orgânico (2,20 kg/dia) foi mais baixa do que a do rebanho convencional (2,66 kg/dia). Os resultados indicaram que as cabras e cabritos mantidos em fazenda orgânica (386±104 e 900±204, respectivamente) apresentaram maiores valores de OPG ($p<0,05$) do que aqueles mantidos em fazenda convencional (245±132 e 634±212, respectivamente). O valor médio de OPG nos animais jovens foi superior ($P<0,001$) ao dos animais adultos. A utilização de antiparasitário foi significativamente maior no sistema convencional (50%) quando comparado ao sistema orgânico (1.3%).

Palavras-chave: Cabra, produção de leite, sistema convencional, sistema orgânico, helmintos

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Introduction

Disease caused by internal and external parasites is, arguably, one of the most important health constraints affecting productivity in small ruminants kept in organic system. This is of particular importance for many tropical and subtropical countries where goats play a vital role in the agricultural economies (JACKSON; VARADY; BARTLEY, 2012). In goats at pasture, parasitized animals have reduced the efficiency of production by decreasing voluntary feed intake, live weight gain, milk yield, and carcass quality (MORENO-GONZALO et al., 2012).

Organic agriculture has expanded in Brazil over the last five years (SOARES et al., 2012). In 2005, the organic milk production in Brazil was estimated to 0.01% (2.4 million liters) of the total milk production. However, in 2010, this production had increased to 0.02% (6.8 million liters) of the national milk production (SOARES et al., 2012).

There is not only a consumer interest for these products but also a political (CEDEBERG AND MATTSSON, 2000) and environmental one. The growth of markets increasingly interested in products with no chemicals has encouraged producers in agro-exporting countries to adopt organic production systems (SILVA; FAGUNDES; FONSECA, 2011). Despite anthelmintics are not always used in conventional farms (HÖGLUND et al., 2010), the growing consumer concern and increasing awareness among veterinarians of chemotherapeutic resistance have resulted in stricter control of use of veterinary medicines (THAMSBORG; ROEPSTORFF; LARSEN, 1999). Indeed, the prohibition of prophylactic anthelmintics, is a crucial aspect should be taken into account in organic livestock production.

Furthermore, the extensive use of these chemicals seems to be the origin of the possible development parasite resistance. Goats have had a long established link with anthelmintic resistance and many of the earliest cases of multiple resistances

were reported (PARAUD et al., 2009). In addition, common external parasites and bacterial diseases may cause several problems to animal health. Thus, this article aimed to measure risk factors on health management and milk production on organic and conventional dairy goats in Brazil.

Materials and Methods

Experimental area

This study was conducted from January 2007 to December 2009 as collaboration between Embrapa Agrobiologia and Universidade Federal Rural of Rio de Janeiro (UFRRJ). Data were collected from 2 dairy herds in southeast of Brazil, in the municipality of Seropédica, Rio de Janeiro, located at latitude 45°S 22nd, 43rd 41'W longitude GRW and altitude of 33 m.

Experimental design

The study was conducted in two dairy goat herds for 3 consecutive years (2007–2009). Two experimental groups (organic and conventional) were evaluated simultaneously. The study design was completely randomized. The experimental group consisted of 40 goats (25 goats and 15 kids) kept in an organic production system and 60 goats (40 goat and 20 kids) under conventional production system. Data from conventional and organic herds was obtained at the Universidade Federal Rural of Rio de Janeiro (UFRRJ). A total of 100 dairy Saanen goats suffering from natural infection were evaluated. All goats were milked twice a day during lactation period. Two herds were visited monthly; totaling 36 visits during the three years of study.

The following health and production variables were investigated: numbers of gastrointestinal nematode eggs per gram of feces, numbers of oocysts per gram of feces, abortions, clinical mastitis, tick counts, louse counts, lameness, antiparasitic use, parasitic resistance, milk yield, labor interval, live-

weight gain in young, young mortality, lactation period, lactating animals, stocking area. The tick counts, louse counts and lameness variables were categorized: absence, low, medium and high. The antiparasitic use variable was categorized: casual, low, medium and high.

Organic system

In the organic farm the goats were kept in 6 pasture (*Brachiaria humidicola*) paddocks at rotational system (5 days), each measuring about 1.5 ha, stocked at 2.2 ha/AU. During the dry season (April–September), the goats received Tifton 85 hay (*Cynodon* spp. hybrid) as roughage supplement and maize silage (*Zea mays*) ad libitum. The parasite control performed on the organic farming was based on rotational grazing, separation of animals by class and according to age, adequate nutrition and roughage supplement (hay and silage). The animals were divided into three groups according to age. The first group consisted for animals of 0–6 months, the second for animals of 7–12 months and the third for animals older than one year.

Conventional system

In the conventional system the goats and kids were kept in *Brachiaria decumbens* stocked at 4.4 ha/AU. The goats fed 1 kg day of concentrate with 22% crude protein. During the dry season, the goats received elephant grass (*Pennisetum purpureum* Schum cv. cameroon) and sugarcane (*Saccharum* spp.) as roughage supplement. The animals under conventional system were dewormed at monthly using levamisole phosphate (10 mg/kg, Ripercol® L 150 F, Fort Dodge, Brazil) and Albendazole (10 mg/kg, Valbazen® 10 Cobalto, Pfizer, Brazil). Anthelmintic rotation was used, with a different active principle employed in each month.

Clinical mastitis

Clinical mastitis (CM) was defined as a goat having a swollen or hard udder or noticeable clots or strings in its milk. Recurrent episodes of disease were counted as the same case if the recurrence occurred within 2 weeks of initial onset. Animals with multiple quarters affected with CM were counted as the same case. The CM rate for each herd was calculated as the number of CM cases per 100 goat-years at risk.

Fecal egg count

Fecal samples were collected fortnightly from all goats during the study. The numbers of gastrointestinal nematode eggs per gram of feces (EPG), from nematodes gastrointestinal and oocyst of protozoa were counted using the McMaster technique, as described by Gordon and Whitlock (1939).

Tick counts

To ticks counts, the animals were restrained individually, and all the fully or partially engorged females of *Rhipicephalus microplus* or *Amblyomma cajennense* measuring between 4.5 and 8.0 mm that were found on the right side of each animal were counted as described by Wharton et al. (1970). The result from each count was multiplied by 2 to obtain the monthly average for each animal.

Tick Susceptibility

Test Immersion Adults (Ivermectin 1%) was employed to evaluate the *in vitro* tick susceptibility (DRUMMOND et al., 1973). The World Association for the Advancement of Veterinary Parasitology (WAAVP) by Coles et al. (1992) methods for the detection of anthelmintic resistance in nematodes were performed.

Statistical analysis

For statistical analysis, the EPG data were initially transformed into $\log_{10}(x + 1)$ in order to normalize them. For quantitative assessment of different parameters, analysis of variance was used, along with the Tukey test at 5% significance. The operating procedures were performed using the statistical software R Foundation for Statistical Computing, version 2.12.2 (2011).

Results

The health and productive parameters in dairy goats are shown in Table 1 and 2. The abortion rate

in the conventional system was 5% (2/40) whereas in organic system no abortion was diagnosed (0/25). The mortality rate at weaning in the conventional system was 5% (2/40) and in the organic system was 8% (2/25). The number of twin pregnancies, birth weight and weaning did not differ ($p>0.05$) among the two systems.

Milk production (2.6 kg/day) in conventional system was higher than in the organic system (2.2 kg/day). As can be noted in Table 1, milk yield per goat was 21% lower on the organic farm compared with the conventional farm ($p=0.021$). As expected, treatment with antiparasitic was higher in conventional system (50%) than organic system (1.3%).

Table 1. Management and production variables on organic and conventional dairy goat.

Productive parameters	Goat (2007)		Goat (2008)		Goat (2009)	
	Organic	Conventional	Organic	Conventional	Organic	Conventional
Number of lactating goats	25	40	25	40	25	40
Milk yield (kg/day)	2.0±0.422	2.4±0.234	2.0±0.978	3.0±0.472	1.4±0.812	2.6±0.338
Kidding interval (months)	12±1.2	10±1.0	11.5±1.4	12±1.1	12±1.5	11±1.1
Live-weight gain in kid (g/day)	90±17.2	180±12.3	108±18.2	118±10.3	95±15.3	112±14.2
Lactation period (days)	270±10	240±8	265±30	240±10	270±15	240±12
Kid mortality	8.0%	5.0%	4.0%	2.5%	0.0%	5.0%
Lactating goat (%)	68%	70%	80%	87.5%	92%	90.0%
Stocking area (animals/ha)	10	20	10	20	10	20

Source: Elaboration of the authors.

Table 2. Sanitary parameters on organic (n=25 goats and 15 kids) and conventional system (n=40 goats and 20 kids).

Health parameters	Goat (2007)		Goat (2008)		Goat (2009)	
	Organic	Conventional	Organic	Conventional	Organic	Conventional
FEC*/adult animals	470±56	250±108	370±186	300±121	200±145	290±112
FEC*/ young animals	1000±345	600±210	950±400	710±320	750±210	670±150
Tick count	0±0	10±8	0±0	5±5	0±0	10±5
Louse count	0±0	5±3	2±2	0±0	0±0	0±0
Number of cases of lameness	0	2	0	0	2	0
Abortions (%)	0.0%	5.0%	4.0%	2.5%	0.0%	5.0%
Clinical mastitis (%)	4.0%	5.0%	8.0%	7.5%	4.0%	5.0%
Antiparasitic use (%)	0.0%	25.0%	4.0%	50.0%	0.0%	75.0%

*FEC= Fecal Egg Count

Source: Elaboration of the authors.

There were no differences ($p>0.05$) in fecal egg count between herds in all years of the study. Despite no access to anthelmintic treatment on organic farm, egg counts remained moderate and did not exceed 1000 EPG/animal. However, in the conventional herd, it was 710 EPG/animal, even under anthelmintic conditions (Table 2).

The mean fecal egg count in goats under organic and conventional systems is shown in Table 3. In this study, *Trichostrongyloidea*, *Trichuris* spp., *Strongyloides papillosus*, *Toxocara vitulorum*, *Moniezia expansa* and *Eimeria* spp. was found. No treated goats under organic conditions had higher FEC ($p<0.05$) than animals throughout conventional system. In addition, Saanen kids had higher FEC ($p<0.001$) than goats.

Discussion

The high coefficients of variation for most variables observed on the study confirms the results reported by Toro-Mujica et al. (2011), indicating the diversity of productive-factor handling techniques in both systems.

The decrease milk production, low reproductive efficiency and an increase in cost of land and hand labor in the organic system, provide high costs per liter of milk produced. According to Soares et al. (2012), organic milk production in Brazil is economically viable, since a capital return of 5% per year higher than 2% per year obtained by the conventional system is possible. Thus, the reduction in milk yield is compensated by the higher added value of milk.

Treatment with antiparasitic drugs was higher in conventional system (50%) than organic system (1.3%). This finding corroborates two recent reports (SVENSSON; HESSLE; HOGLUND, 2000; SILVA; FAGUNDES; FONSECA, 2011) whose observed a high incidence in antiparasitic drugs in conventional system.

Although in the present study, organic herd showed higher FEC values than conventional herd during three years study period, the results were satisfactory. Since the organic system is self-sustaining, environmentally correct and animal welfare-promoting, the parasite load is considered tolerable and compatible with the production model (SILVA; FAGUNDES; FONSECA, 2011).

Since degree of gastrointestinal parasitism is very high in tropical and subtropical areas, especially in genetically improved animals, like Saanen (AMARANTE et al., 2004), a greater fecal egg counts were expected. Nevertheless, a nutritional manipulation can be considered as a tool that can help to control infections with gastrointestinal parasitism in goats reducing their dependence on conventional anthelmintic treatments (TORRES-ACOSTA et al., 2012).

Internal parasites are one of the main causes for lower heifer growth and reduced milk production in older animals (SATO et al., 2005). Anthelmintic treatment is prohibited on organic dairy farms, so the prevalence of gastrointestinal nematodes in organic goats could expectedly be higher than what is commonly found in conventional dairy herds. Therefore, our results may indicate that the organic farms may have a greater worm burden because of the increased use of grazing.

Table 3. Fecal egg count (FEC) values (average and standard deviation) among goats and kids maintained in the organic and conventional production systems.

Animals	Trichostrongyloidea	<i>Trichuris</i> spp.	<i>S. papillosus</i>	<i>Moniezia benedeni</i>	<i>Eimeria</i> spp.
Goat of organic	386.00±104 ^{Ca}	160.00±20 ^{Ac}	00.00±75 ^{Bd}	120.20±60 ^{Ac}	290.00±90 ^{Cb}
Goat of conventional	245.00±132 ^{Ca}	100.00±18 ^{Bb}	00.00±90 ^{Bd}	50.00±22 ^{Bc}	180.45±76 ^{Ba}
Kid of organic	900.50±204 ^{Aa}	12.00±32 ^{Cd}	190.50±121 ^{Ab}	100.00±31 ^{Ac}	1200.00±245 ^{Aa}
Kid of conventional	634.112±212 ^{Ba}	10.00±43 ^{CD}	160.00±50 ^{Ab}	45.00±89 ^{Bc}	626.34±260 ^{Ba}

Average and standard deviation followed by capital letters in the same column and lower case differ among themselves by parametric Tukey test at 5% of probability respectively.

Source: Elaboration of the authors.

Conclusion

The low levels of parasitism observed in goats raised under organic system were considered satisfactory, since the control strategy aim was to maintain low levels infection and not achieve a complete eradication of the parasites.

The distribution of gastrointestinal helminthes of Saanen goats in organic production system did not constitute a health risk for the animals. However, the results suggest that even among well-managed adult, kids are an important risk factor in the epidemiology of gastrointestinal nematode infections.

Conversely, certain managements, like rotational grazing, pasture rest periods, nutritional supplementation and stocking rate play an important role in the gastrointestinal nematodes control on organic dairy farms.

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